

Effect of Ambipolar Potential on the Propulsive Performance of the GDM Plasma Thruster, Phase II

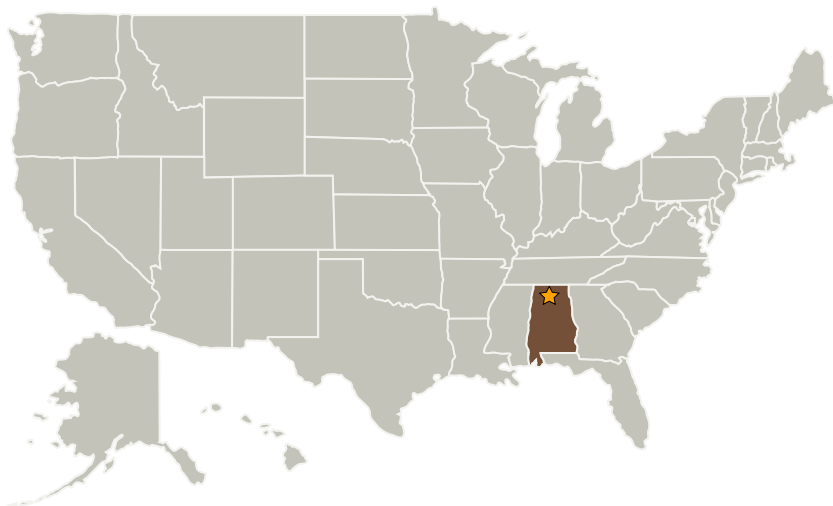
Completed Technology Project (2005 - 2007)



Project Introduction

The Gasdynamic Mirror (GDM) thruster is an electric propulsion device, without electrodes, that will magnetically confine a plasma with such density and temperature as to make the ion-ion collision mean free path much shorter than its length, but the macroscopic time scale is smaller than the characteristic time for electron-ion equilibrium. So, the electrons and ions have different temperatures and the magnetic mirror field induces an ambipolar axial electrostatic field which, acting with the nozzle effect of the diverging magnetic field, will accelerate the ions exiting the GDM in a jet along the centerline, giving the thruster a specific impulse that is up to 30 times greater than a comparable device in which the hot propellant is expanded adiabatically. The density and temperature ranges and the basic mode of GDM operation mesh well with electric power input by microwaves via Electron-Cyclotron Resonance Heating (ECRH). A combined ECRH/GDM thruster will have an operating envelope that will span the gap (about two orders of magnitude in density) between ion engines and magnetoplasmadynamic (MPD) arc thrusters, without the endurance limitations imposed by electrodes. The proposed research will explore the operational envelope of these thrusters. Experiments have shown that stable operation can be achieved.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Reisz Engineers	Supporting Organization	Industry	Huntsville, Alabama

Primary U.S. Work Locations

Alabama

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.2 Electric Space Propulsion
 - └ TX01.2.3 Electromagnetic